

THE INFLUENCE OF PEER-TO-PEER SOCIAL NETWORKS AND COMPUTER SUPPORTED COLLABORATIVE LEARNING (CSCL) IN MATHEMATICS

**MOHINIMOHAMED, WASUGIGUANDASAMI, DAYANGTIAWAAWANG HAMID &
ARDIYANSYAH SHAHROM**

Department of Science, Mathematics and Creative Multimedia, Faculty of Education, Universiti Teknologi, Malaysia

ABSTRACT

This research was designed to investigate students' interest towards computer supported learning process for mathematics lesson, students' interest on the use of Geogebra in mathematics lesson and students' perception on collaborative learning through social networking. This study employs mixed methods which is a combination of quantitative (questionnaire) and qualitative (interviews and observations) approach. Students were taught a mathematical topic on transformation with the aid of Geogebra software and are encouraged to have peer-to-peer interaction through social media (Facebook) to complete their assignment. Thirty 13 years old Form Two students were involved in this study and consequently five students were selected for further in-depth interview session. Results of the study indicated that students had high level of interest towards computer supported learning, on the use of Geogebra in mathematics lesson and collaborative learning through social networking.

KEYWORDS: Peer-to-Peer Learning, Social Networks, Collaborative Learning, Computer Supported Collaborative Learning (CSCL), Transformation in Mathematics

INTRODUCTION

Information technology has made a significant change to traditional education system. There is an emergence of competition and concerted efforts towards the formation of a world-class education system. According to several researchers, there has been an increase in teaching science and mathematics subjects with the aid of multimedia technology, namely computers and special software [1], [2], [3]. According to other researcher, the growth of technology is a fundamental fact to the development of technology in education. Technology is regarded as a powerful yet exciting gateway to all aspects of education, learning and teaching. [4]

Students' abilities and capabilities are being enhanced with these technologies [5]. Besides that, technology is capable of producing visionary students with capabilities in both advanced technology and subject matters [2]. Technology such as internet plays a pivotal role in enhancing education as it can provide diverse opportunities for transformations in education [6]. Without a doubt; ICT has potential benefits for educators and learners in producing an interactive learning environment. Previous studies have recommended the use of ICT for positive change in education [7].

However this study is designed to explore the perception of students in terms computer supported learning as well as the use of social networking to cultivate collaborative learning. Geogebra software has been used to teach the topic on Transformation for Form Two secondary school students and subsequently Facebook is selected as a platform to create collaborative learning.

RESEARCH OBJECTIVES

The objectives of this study are to investigate students' interest towards computer supported learning in mathematics lesson for the topic on Transformation, the use of Geogebra software and their perception on collaborative learning through social networking among Form Two students.

BACKGROUND OF THE STUDY

Constructivism approach emphasizes the involvement and participation of students during learning and teaching process. Students are encouraged to voice out their own idea or their perception about the lesson. During the learning process, various activities which lead to involvement of students such as experiments, assignments, question and answer session are encouraged. Constructivism approach enables students to understand the information or knowledge during learning process through experimental method. Constructivism approach indirectly support cooperative based learning process where students are involved in group activities and discussion session with other students to understand or produce new knowledge.

Information, Communications and Technologies (ICT) in Education

Advancements in the internet, computer, information, communications and technologies (ICT) and online education are new refreshing tools for teaching and learning. This has convinced the mass that these technologies could revolutionize and enhance education. They also broaden the access to educational services for students and widen global outreach for many academic institutions. ICT becomes an umbrella in teaching and learning that covers the different kinds of technological tools and resources used to create, store and deliver information. ICT in education is more learner-centered, knowledge-centered, assessment-centered and community-centered [8]. As from the viewpoint of learners, ICT could help students to improve their learning process.

Information, Communication and Technology (ICT) in Mathematics

Current advanced in technology has changed the way mathematics lessons been conducted in the classrooms. The present technology has a great influence and contributions towards educational practices in the classrooms. Currently, computer aided technology (CAT) is being practiced to enhance the instruction, delivery and transfer focus from the teacher to the students during learning process [1], [9]. According to several researchers, an interactive and engaging learning process is an effective learning methodology where instructors prefer their students can actively participate throughout the learning process as well as to enjoy and be passionate about learning [10].

The researcher stated that the incorporation of mathematical software in teaching and learning is important due to its ability to do quick calculations and also helping students to visualize challenging mathematical concepts [2]. There is various existing mathematical software available like Maple, Geometers, Mathematica, Sketchpad, Autograf and others. In this study, GeoGebra is used as a form of open source software to incorporate into the teaching and learning of Transformation topic for Form Two students.

Geogebra

GeoGebra (from Geometry and Algebra) is one of the most innovative, open -code math software (GNU General Public License) which can be freely downloaded from www.geogebra.org. Geogebra works on a wide spectrum of operating system platforms which have Java virtual machine installed [6]. It is open-source dynamic mathematics software

which is used in teaching and learning throughout middle school to college to the University level [11].

Geogebra software was formulated, created and designed specifically for educational purposes. This software assisted students to grasp experimental, problem-oriented and research-oriented learning of mathematics, both in the classroom and at home [12]. A study conducted by the researcher has shown that mathematics teachers in secondary schools have positive attitude towards the use of GeoGebra. The study concluded that mathematics is an abstract subject that requires the collective imagination of students and teachers, particularly in the areas of geometry and transformations [13]

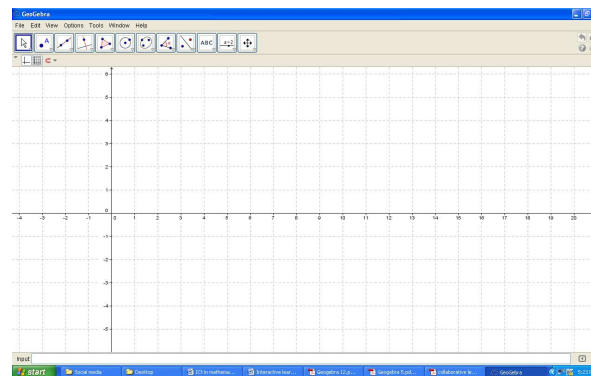


Figure 1: Interface of Geogebra

Computer Supported Collaborative Learning (CSCL) through Social Networking

Computer plays a vital role in learning process as it can work with the imagination of students [13]. Pictures and visual images were able to enhance the understanding of some concept in mathematics. Lessons can be retained for longer time when mathematics being taught with the aid of computers as they optimize multi-senses of the students.

CSCL has a complex relationship to established disciplines which evolves in ways that are hard to pinpoint and includes important contributions that seem incompatible. Furthermore, it is important to view CSCL as a vision of what may be possible with computers and of what kind of research should be conducted, rather than as an established body of broadly accepted laboratory and classroom practices.

As the social networking stormed into the Web 2.0, the education world began to realize the massive population especially young adults and students who are attracted to this network. At the core of social networking sites, there are profiles and network of “friends” that users create. After user signs up in social networking sites such as Facebook, he or she will be prompted to create a profile that varies in sophistication depending on the networking site concerned. Several researchers also cited that Facebook instantly provides a sophisticated profiling system that allows users to create very detailed information about themselves [14].

Social networking sites are argued to be cultivating an effective peer-to-peer as well as teacher-student relationship in support of online discussions which demands constant communication [15]. There are huge potential for the assessment feedback that can be delivered timely, clear, thorough, consistent, equitable and professional [16]. Indeed, interactivity with a variety of quick feedback mechanisms is one of the major advantages of online discussions in social networking sites. This ongoing commentary about the online conversation substitutes for the visual and audio cues that instructors spontaneously provide in face-to-face interaction in traditional classroom [8].

METHODOLOGY

This study deployed both quantitative and qualitative methods for data collection. The study was conducted for four weeks in a secondary school in a rural area in Malaysia. A total number of 30 students participated in this study.

The teacher prepared and conducted the module on the topic of transformation using geogebra tools. The students were given activities through Facebook where they were able to interact and collaborate with each other to complete the activities as a team. Questionnaire was used as first stage of the data collection for quantitative method. As for qualitative approach, interviews and observations were conducted on five students. Pilot study was conducted to assess the reliability of the instrument. Questionnaires were distributed to 15 randomly selected students and subsequently results shows that the Cronbach Alpha coefficient for the whole set of item was 0.787 which is in the range of acceptable value for the purpose of collecting data in the real study.

Table 1: Values of Reliability Coefficient

No.	Constructs	Reliability Coefficient
1	Students' interest towards computer supported learning process for mathematics lesson	0.750
2	Students' interest on the use of Geogebra in Mathematics lesson	0.897
3	Perception of collaborative learning through social networking	0.878
	Overall	0.915

DATA ANALYSIS

Based on the findings, out of 30 respondents who were involved in the study, 12 of them were male students (40%) while the rest were female students (60%). All of them were secondary school students (Form 2), aged 14 years old and they were with the same teacher in a class as a common denominator. A five point likert scale were used in the questionnaire ranging from 1= strongly disagree to 5= strongly agree.

Results from Questionnaire Response

The quantitative analysis showed that there is a positive interest and perception among students towards computer supported learning, on the use of Geogebra software and perception on social networking as collaborative learning medium. This is supported through high average mean value achieved which is ranging from 4.4 to 4.56 as shown in the figures below.

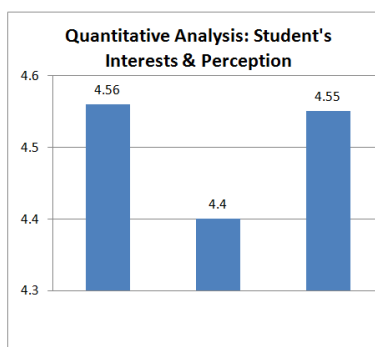


Figure 2: Quantitative Analysis of Students' Interest and Perception

Students' Task

The students were given four activities on the topic of transformation where they learned the detailed steps through Geogebra software earlier in the class. Some examples of their activities on subtopics on rotation, reflection, translation and enlargement and are given below.

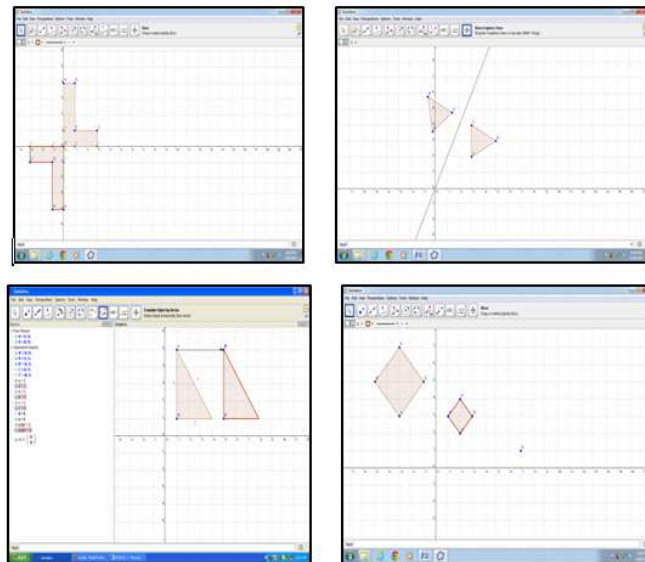


Figure 3: Activities on the Topic of Transformation by Geogebra Software

Interview

The interview and observation session indicated that students were excited in using Geogebra software. Most of the students were capable in learning the tools and were able to complete the activities during the session. The respondents also indicated that the software was user friendly and easy to learn while Facebook is an effective medium for interaction, where collaboration and discussion can be made at their own convenience which eventually culminated into good team working.

Prior to activity session, the teacher has demonstrated the application of Geogebra tools and explains each step involved in completing each activity. However, students who found some difficulties in grasping the Geogebra software stated that the use of Facebook during the activities has enabled them to learn the software application from other mates. The effective interaction and collaborative learning through Facebook has assisted them to successfully complete the activities.

Overall, students showed an overwhelming interest in using Geogebra software in learning mathematics. Meanwhile, Facebook enabled them to share ideas and communicate in a carefree way. Students were more confident to learn and complete the activities partially due to the casual environment created by Facebook.

Furthermore, the collaborative learning through Facebook has changed student's perspective particularly among those who were not internet savvy and reluctant to learn the software. The excitement and eagerness during the interaction in Facebook has changed the character of respondent because Geogebra has given the confidence to solve complex issues in mathematics. The understanding became very much easier with the use of Geogebra especially on complex matters and minimal explanation was required from instructor. Geogebra software has made their learning interesting as well as enables them to understand the lessons easier compared to learning in a traditional classroom.

In conclusion, the respondents agreed that Geogebra software is a good option in learning mathematics. In terms of peer-to-peer networking, all of the respondents have agreed that Facebook is an effective collaborative learning medium. On the bright side, Facebook may decrease math anxiety and improve self confidence and these could well create a positive ambience in learning mathematics.

Students' Interest towards Computer Supported Learning

Through the student conversations in the chat room, it can be seen students give positive response towards their interest in the use of computers as a teaching medium. The comments provided show how the use of computers in teaching and learning of mathematics affect their interest to continue to learn. For example, many students expressed their hope and desire to learn more mathematics with computer-aided medium. Besides that, there are comments indicate that students not only want to learn mathematics with computers but want to learn in greater detail. In addition, computer use increased student interest because they could see how their friends help them in learning mathematics. As a result, there are comments that mentioned they felt good when assisted by their peers. Student self-motivation is also seen to be maintained where there are comments stated that they do not want to take a break but just to continue doing mathematics activities. Finally, the use of words and smiley icons that are used as "he, he ..." and " thumbs up icon" shows how students feel good with computer-aided learning in learning mathematics.

Students Interest on the use of Geogebra in Mathematics Lesson

Regarding the use of Geogebra software in mathematics classes, several students responded in a positive way. Good feedbacks are given including their interest in the use of this software. For example, there are students who uploaded videos from YouTube site on the use of Geogebra in learning Transformation topic. It shows how students strive to find related materials about Geogebra. Initiatives taken by the students showed their interest in the use of Geogebra and they were eager to share it with other friends. Students also commented positively on the use of computers in the learning process, they seem to enjoy learning when they persisted doing the transformation activities even without going for a break. Numerous smiley icon indicated students' positive response in learning mathematics by using Geogebra.

Facebook as an Effective Tool for Collaborative Learning

From the students' activities and expressions through the chat room, it can be said that the students were impressed with collaborative learning methods. This can be proved by three things that showed up in the chat room. First, there are students who take the initiative to upload videos related to learning as additional reading material to share to their friends if they do not understand or have forgotten about what they have learned. Second, students give each other feedback when there are friends who have any queries and questions related to the activities. Finally, the collaborative learning seems to be able to sustain student's motivation to remain in the assigned tasks and activities.

DISCUSSIONS

These findings showed that students have shown positive interest towards the use of Geogebra in mathematics lesson. Geogebra has enhanced the learning process as well as students' thinking skills. Computer supported learning encouraged creative thinking among students to explore and trying new things or doing old things in new ways. This is consistent with the study conducted before which found that Geogebra provided multiple representations and visualization of indispensable mathematics concepts [17]. Computer supported learning exposed students to the exploration of new

methodologies for solving problems and promotes thinking out of the box.

The results showed that students had learned each steps of transformation much faster through the CSCL. It showed that computer supported learning enhances the learning process and specifically contributes to make the understanding very much simpler as supported by finding before which found positive impact of utilizing mathematical software thus enhancing students learning and understanding [2].

Apart from the results of their activities, the selected respondents' reactions such as explanation on each steps during the interview sessions clearly showed that the students benefited very much from the Geogebra software. Within a short period of time, the students were able to grasp and apply the tools in the Geogebra software effectively and completed the activities. This may be due to added self confidence and motivation among students resulted from the use of Geogebra software and Facebook in learning.

Interaction among students in Facebook showed that Facebook is an effective collaborative learning to enhance the learning process. Based on findings during interview sessions, it revealed that Facebook enables idea sharing, encourages self confidence and problem solving. Moreover, students expressed that Facebook provides relaxing environment and taking off some of their anxieties. This is due to collaborative learning through Facebook where complex matters could be discussed and solved together among their fellow mates at their own convenience in terms of time and venue.

The students' positive perception on Facebook were consistent with the study by researcher where social technologies coupled with a paradigm of learning focused on knowledge creation and community participation offer the potential for radical and transformational shifts in teaching and learning practices, allowing learners to access peers [18]. The importance of interpersonal interaction in learning theories put special emphasis on the effects of interpersonal interaction on learning outcomes.

The learning of mathematics through peer-to peer social networking further boosted friendship factor where the students felt more comfortable in interacting with their fellow mates, understanding the lessons and collaborate on solving mathematic problems. This is in contrast to traditional classroom method where students rely very much on instructor. This is in parallel with the study conducted by several researchers that centrality in friendship networks is related to team-based learning satisfaction and performance [19]. Meanwhile another study found that friendship through social networking usually serves as psychological function of companionship [4]. Therefore the students' positive perceptions and interest shown on Facebook in this study is well supported by previous studies.

CONCLUSIONS

This study has concluded that there are positive perception and interest towards computer supported collaborative learning and the use of Geogebra software in mathematics lessons. In terms of collaborative learning, this study has concluded that social networking like Facebook could play pivotal role to create online collaborative learning medium. The findings of this study are supported and consistent with previous studies as mentioned in earlier section.

Teaching and learning mathematics lesson via CSCL has able to improve students' learning performance as well as their thinking. CSCL challenges students to practice broad minded and creative thinking which is quite different from traditional teaching and learning method. Therefore this study concludes that Geogebra software contributes significantly

to the mathematics lesson in terms of learning adaptability, problem solving and thinking capability. The combination of social networking further enhances the learning in terms of ideas sharing and interactive communication among students.

ACKNOWLEDGEMENTS AND DISCLAIMER

We would like to express our gratefulness to Universiti Teknologi Malaysia and Ministry of Sciences, Technology and Innovation (MOSTI), Malaysia for supporting and funding this study under vote 4F251

Part of this paper has been presented in The International Conference on Computing Technology and Information Management (ICCTIM2014) in Dubai.

REFERENCES

1. AzitaManoucherhi, "Computers and School Mathematics Reform: Implications for Mathematics Teacher Education. *Journal of Computers in Mathematics and science Teaching* 18(1), pp: 31-48. Retrieved March 18, 2014 from: <http://www.editlib.org/p/8893>, 1999.
2. Kamariah Abu Bakar, Ahmad FauziMohdAyub and Rohani Ahmad Tarmizi, "Dynamic Mathematical Learning Tools: Does It Work For Malaysia Classroom Learners?" *Journal of Advance in Technology, Education and Development*, pp. 73-88, 2009.
3. Yuan-Hsuan Lee, Hersh Waxman, Jiun-Yu Wu, Georgette Michko and Grace Lin "Revisit the Effect of Teaching and Learning with Technology. *Educational Technology & Society*, 16(1), 133-146, 2013
4. HomaEdalatiFard, Zaidatun Nasir and Azidah Abu Ziden "A Social Networking Website Based on Peer Learning". Master Thesis Universiti Teknologi Malaysia, Faculty of Education, 2009.
5. Al-A'ali and Mansor, "A Study of Mathematics Web- Based Learning in Schools" *American Journal of Applied Sciences* vol 5 Issue 11, p1506-1517. 12p, 2008.
6. David L. Baker, "Designing and Orchestrating Online Discussion", *Journal of Online Teaching and Learning*, Vol.7 (3), 2011.
7. Terry Anderson, Distance Learning –Social software's killer ap? Retrieved: March 18, 2010 from: <http://www.unisa.edu.au/odaconference> PPDF2/13%200D199%20, 2005.
8. Mohamad IbraniShahrimin and Dawn M Butterworth, "Young Children's Collaborative Interactions in a Multimedia Computer Environment. *Internet and Higher Education*" 4, University Putra Malaysia, 203-215, 2002.
9. Benbunan, FichR and Hiltz, S, Educational application of (MSS: Solving case studies through asynchronous learning network. *Journal of computer –Mediated communication* 4(3), 1999.
10. Judith V. Boettcher, "Ten Core Principles for Designing Effective Learning Environments: Insights from Brain Research and Pedagogical Theory", 2007.
11. Pierre Dillenbourg, Sanna Jarvela and Frank Fischer, "Basics of Computer Supported Collaborative Learning". *Ecole Polytechnic Federale de Lausanne, Switzerland*. 21, pp.111-130, 2007.
12. Dallas Elliot, "Internet Technologies and Language Teacher Education", in Michael Thomas, (Ed), *Handbook of Research on Web 2.0 and second language learning*, pp.432-450, IGI Global, Hershey, PA, 2009.

13. Christopher Emmanuel RajVellan, "Students' Perception towards Meaningful Learning through E-Learning and Social Networking Sites as Medium for Teaching and Learning" Degree Thesis: UTM, 2012.
14. Danah Boyd and Nicole B. Ellison, "Social Network Sites: Definition, History and Scholarship". Journal of Computer-Mediated Communication, 13(1), pp. 210-230, 2008.
15. Kamariah Abu Bakar, Ahmad FauziMohdAyub and Rohani Ahmad Tarmizi, "Exploring the Effectiveness of Using Geogebra and E-transformation in Teaching and Learning Mathematics". Advanced Educational Technologies, 19-28, 2010.
16. Naser Jamil al-Zaidiyeen, Leong Lai Mei and Fong Soon Fook, "Teachers' Attitudes and Levels of Technology Use in Classrooms". The Case of Jordan Schools. International Education Studies, 3(2), 211-218, 2010.
17. Zengina Y, Furkanb H, and Kutluca T, "The effect of dynamic mathematics Software Geogebra on Respondent achievement in teaching of trigonometry" Procedia Social and Behavioral Sciences 31(2012), 183-187, 2011.
18. Paul A. Kirschner, "Using Integrated Electronic Environments for Collaborative Teaching/Learning Research Dialogue in Learning and Instruction". University of the Netherlands, 1-9, 2001.
19. Timothy T. Baldwin, Michael D. Bedell and Jonathan L. Johnson, The Social Fabric of a Team-Based M.B.A. Program: Network Effects on Students Satisfaction and Performance. Journal of Academy of Management. From: <http://amj.aom.org/content/40/6/1369.short>, 1997.

